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EXAMINER				
BARTON, JEFFREY THOMAS				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/726,744

Applicant(s)

OLSEN ET AL.

Examiner

Jeffrey T. Barton

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 April 2009.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3, 5-18, 23-25 and 37-39 is/are pending in the application.
4a) Of the above claim(s) 2 and 23-25 is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1, 3, 5-18 and 37-39 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/US)
Paper No(s)/Mail Date 20080916, 20090203, 20090326.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1, 3, 5-18, and 37-39, drawn to a thermoelectric power source having co-sputtered and/or nonstoichiometric compound thermoelements, classified in class 136, subclass 205.
 - II. Claim 2, drawn to a thermoelectric power source having thermoelements of specified L/A ratios, classified in class 136, subclass 205.
 - III. Claims 23-25, drawn to thermoelectric power sources having thermoelements with thicknesses greater than 0.1 mm, classified in class 136, subclass 205.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and (II or III) are directed to related products. The related inventions are distinct if: (1) the inventions as claimed are either not capable of use together or can have a materially different design, mode of operation, function, or effect; (2) the inventions do not overlap in scope, i.e., are mutually exclusive; and (3) the inventions as claimed are not obvious variants. See MPEP § 806.05(j). In the instant case, the inventions as claimed can have materially different design (i.e. the devices of Group I need not have L/A ratios as claimed in Group II or the element thicknesses claimed in Group III and the devices of Groups II and III need not have a co-sputtered or non-stoichiometric thermoelement). Furthermore, the inventions as claimed do not

encompass overlapping subject matter and there is nothing of record to show them to be obvious variants.

3. Inventions II and III are directed to related products. The related inventions are distinct if: (1) the inventions as claimed are either not capable of use together or can have a materially different design, mode of operation, function, or effect; (2) the inventions do not overlap in scope, i.e., are mutually exclusive; and (3) the inventions as claimed are not obvious variants. See MPEP § 806.05(j). In the instant case, the inventions as claimed can have materially different design (i.e. the devices of Group II need not have the element thicknesses of Group III, and the devices of Group III need not have the L/A ratios claimed in Group II). Furthermore, the inventions as claimed do not encompass overlapping subject matter and there is nothing of record to show them to be obvious variants.

4. Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and examination burden if restriction were not required because one or more of the following reasons apply:

- (a) the inventions have acquired a separate status in the art in view of their different classification;
- (b) the inventions have acquired a separate status in the art due to their recognized divergent subject matter;

- (c) the inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries);
- (d) the prior art applicable to one invention would not likely be applicable to another invention;
- (e) the inventions are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention.**

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected invention.

If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

5. During a telephone conversation with Lisa Caldwell on 9 April 2009 a provisional election was made without traverse to prosecute the invention of Group I, claims 1, 3, 5-18, and 37-39. Affirmation of this election must be made by applicant in replying to this Office action. Claims 2 and 23-25 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Response to Amendment

7. The Declaration filed on 2 January 2009 under 37 CFR 1.131 is sufficient to overcome the Stark et al reference. (US 2004/0231714) Accordingly, all rejections relying upon Stark et al are withdrawn.

8. All rejections of claims 2 and 23-25 are obviated by Applicant's election of Group I, claims 1, 3, 5-18, and 37-39.
9. All other rejections are withdrawn due to Applicant's amendments.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

11. Claims 1, 3, and 5-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. There is no disclosure of a "greater than in incidental amount of a non-stoichiometric compound" in the specification as originally filed. The specification teaches Bi_xTe_y , Sb_xTe_y , and Bi_xSe_y materials where "x is typically about 2 and y is typically about 3" (Page 10, lines 6-8) This does not provide any clear support for the new language introduced into the claim by the most recent amendments. Claims 3 and 5-18 depend from claim 1, and are rejected on the same grounds.

12. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

13. Claims 1, 3, and 5-18 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear what is meant by the limitation to "greater than in incidental amount of a non-stoichiometric compound". Is applicant intending to limit to variation from $x=2$ and $y=3$ by a greater than incidental amount? What is considered to be an "incidental amount"? There is no basis in the specification for determining the metes and bounds of claim 1, which is therefore considered to be indefinite. Claims 3 and 5-18 depend from claim 1, and are rejected on the same grounds.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

16. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

17. Claims 1, 3, 5-10, 12-15, 17, 18, and 37-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Migowski (WO 89/07836; references below are made to the English translation of this document provided by Applicant) in view of Böttner. (21st Int'l Conf. on Thermoelectronics reference)

Regarding claims 1 and 37, Migowski discloses a thermoelectric power source comprising a flexible substrate having an upper surface (Page 3, 1st full paragraph); a plurality of thermoelectric couples, with the thermoelectric couples comprising: sputtered thin film p- and n-type thermoelements (1 and 2) as claimed (Paragraph bridging pages 2 and 3; Page 3, 1st full paragraph; Page 4, paragraph beginning with "Figure 1a . . .") and an electrically conductive member (3) positioned on the flexible substrate and connecting the p- and n-type thermoelements as claimed (Figure 2; Page 4, paragraph beginning with "Figure 1a . . ."); and wherein the thermoelectric couples are formed on a single substrate and rolled into a coil configuration. (Paragraph bridging pages 2 and 3)

Regarding claim 3, Migowski teaches element lengths of 0.75 mm, widths of 0.1 mm, and thicknesses of 0.005 mm. (Page 4, paragraph beginning with "Layer thickness: . . .") This provides an area of 0.0005 mm^2 , and an L/A ratio of 1500 mm^{-1} , which meets the limitations of this claim.

Regarding claims 5 and 6, Migowski teaches 7500 thermocouples on a substrate, which produces 11 microwatts at 1.6V. (Page 4, paragraph beginning with "Layer thickness: . . .")

Regarding claim 8, Migowski teaches thermoelements that are 5 micrometers thick. (Page 4, paragraph beginning with "Layer thickness: . . .")

Regarding claims 13 and 39, Migowski teaches rolling a 30 cm long polyimide film (Paragraph bridging pages 2 and 3) having thermocouples with exemplary dimension of about 0.75 mm wide (Page 4, paragraph beginning with "Layer thickness: . . ." in conjunction with orientation of figure 2) Such a rolled-up device will clearly have volume less than 10 cm^3 . Migowski further teaches outputs of about 11 microwatts. (Page 4, paragraph beginning with "Layer thickness: . . .")

Regarding claim 15, Migowski teaches power output with a temperature difference of 6 °C. (Page 4, paragraph beginning with "Layer thickness: . . .")

Regarding claim 18, Migowski teaches a polyimide substrate. (Page 3, 1st full paragraph)

Regarding claim 24, upon coiling and positioning in the watch, the thermocouples of Migowski will be positioned electrically in series and thermally in parallel, which meets the limitations of the claim.

Although Migowski suggests forming the thermocouples from known materials, including Bi, Sb, and Te (Page 3, 3rd full paragraph), he does not explicitly teach non-stoichiometric or co-sputtered compounds as claimed.

Böttner is cited as teaching co-sputtered non-incidental amounts of non-stoichiometric thin films of n- and p-type bismuth/antimony telluride compounds as thermoelectric material used in forming thermocouples on a substrate. (Figures 11a and 11b, for example; "Growth of Thermoelectric Materials" section on page 514) Specific to claim 17, figure 11b shows preparation of numerous non-incidental amounts of non-stoichiometric n-type bismuth antimony telluride materials, which do not contain selenium. Specific to claim 37, the p-type thermoelements of Böttner comprise Sb_xTe_y . ("Growth of Thermoelectric Materials" section on page 514; Figure 11a), and note also the disclosure of Figure 4, which shows superlattices also comprising Sb_xTe_y .

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Migowski by specifically selecting the thin film bismuth/antimony tellurides or superlattice $(Bi,Sb)_2Te_3/Sb_2Te_3$ as the thermoelectric materials, as taught by Böttner, because Migowski suggests forming the thermocouples from bismuth, antimony and tellurium, and Böttner demonstrates the effectiveness of these materials as thermoelectric materials. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Further regarding claims 3, 7, 9-10, 14, and 38, the choice of a specific volume for the device and a power output are dependent on the specific application for the

device. The specific wiring methods, series or parallel, also affects the power/current outputs for the device and are well known within the art to alter the wiring to meet the specific requirements of an application. Absent any unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to choose a specific volume, wiring method and output power as within the claims for the device of Migowski. The choice of element length and width, as well as the ratio between them, is a further design choice that is obvious to one skilled in the art, absent any evidence of criticality or unexpected results. Therefore these claims are also obvious over the combination of art described above.

Regarding claim 12, although Böttner teaches co-sputtered films as claimed, it is noted that the limitation to "co-sputter deposited thin films" is directed to formation of a product by a process, which does not further define the structure of the claimed device. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

18. Claims 11 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Migowski and Böttner as applied to claims 1, 3, 5-10, 12-15, 17, 18, and 37-39 above, and further in view of Bass et al. (US 6,207,887)

Migowski and Böttner are relied upon for the reasons given above.

Neither Migowski nor Böttner explicitly discloses a device with pluralities of thermoelements connected in series and parallel precisely as claimed.

Bass et al disclose a series-parallel connection scheme for a thermoelectric generator (Figure 13A; Column 6, lines 46-62) in which plural n-type elements are connected electrically in parallel and are connected in series to a plurality of p-type elements that are connected to each other in parallel.

It would have been obvious to one having ordinary skill in the art to further modify the device of Migowski by employing the series-parallel connection scheme of Bass et al, because Bass et al teach that such connection protects against complete power loss in the event of damage to a single thermoelement, thus providing increased reliability. (Column 6, lines 46-62)

Response to Arguments

19. Applicant's arguments filed 2 January 2009 and 7 April 2009 have been fully considered but they are not persuasive. The arguments are largely moot due to the new grounds of rejection and Applicant's election, but where they pertain to the rejections made above, they are addressed below.

Applicant argues that co-sputtering necessarily results in a compound that is primarily non-stoichiometric. This is not true, as evidenced by a reference provided by Applicant. Specifically, the second and third sentences of the abstract of the Kim et al reference [Thin Solid Films, 510 (2006) 148-153.] states:

"Co-sputtering method with Bi and Te targets was adopted to control films' composition. Bi_xTe_y thin films were elaborated at various deposition temperatures with fixed RF powers, which yielded the stoichiometric Bi_2Te_3 film deposition without intentional substrate heating."

Therefore, it is clear that co-sputtering can be used to make stoichiometric as well as non-stoichiometric films, in contrast to Applicant's assertions. In any event, the limitations to co-sputtered and/or non-stoichiometric films are taught by Böttner, and the claims are therefore not patentable for the reasons presented in detail above. Note that the Sun et al [J. Phys Condens. Matter 19 (2007) 446004] and Kim et al references provided by Applicant with the response of 7 April 2009 are made of record herein.

The declaration of John DeSteele filed on 7 April 2009 provides no evidence sufficient to overcome the rejections of the elected claims. Note that the 15000 cm^{-1} L/A ratio attributed to Migowski in the declaration meets the limitations of claim 3. Note in addition that no evidence is provided to demonstrate criticality of other recited dimensions in the claims examined herein.

Applicant further argues that the combination of Migowski with Bass is improper, because the respective disclosures include structural differences. The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). The rejection involves no "[attempt] to combine the monolithic (three-dimensional) block series-parallel approach of Bass with the flat (two-dimensional) Migowski device",

argued against by Applicant. Bass et al teach that connection of plural thermoelements of the same conductivity type electrically in parallel protects against complete power loss in the event of damage to a single thermoelement, thus providing increased reliability. (Column 6, lines 46-62) A skilled artisan would have recognized the advantage of such a structure in any thermoelectric device having such thermoelements, such as that of Migowski, and would have had full expectation that the benefit taught by Bass et al would be achieved. Applicant has provided no rebuttal to this position, instead providing arguments contrasting the respective device designs in the references that are irrelevant to the rejection made. The rejection is therefore maintained.

Conclusion

20. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey T. Barton whose telephone number is (571)272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeffrey T. Barton/
Examiner
10 April 2009